SOIL NITROGEN MINERALIZATION POTENTIAL

S - 3.60

Anaerobic Method

Scope and Application

This method involves the semiquantitative extraction of minerizable ammonium nitrogen based on a anaerobic incubation as described by Keeney (1982). Minerizable nitrogen is determined by spectrophotometric, diffusion-conductivity instruments or distillation techniques. Mineralizable nitrogen is used to predict available soil nitrogen for plant response to nitrogen fertilizers. The method detection limit is approximately 0.2 mg kg-1 (on a dry soil basis) and is generally reproducible ± 7%.

Equipment

1. Analytical balance: 100.0 g capacity, resolution ± 0.01 g.
2. Repipette dispenser, calibrated to 25.0 ± 0.2 mL.
3. Reciprocating horizontal mechanical shaker, capable of 180 oscillations per minute (opm).
4. Extraction vessels 125 mL and associated filtration vessel.
5. Whatman No. 42 or equivalent highly retentive filter paper.
6. Spectrophotometer, or flow injection analyzer (FIA), or distillation instruments.
7 Incubator capable of 40 ± 0.5 °C.

Reagents

1. Deionized water, ASTM Type I grade.
2. Potassium chloride extracting solution, 2.0 N KCl: Dissolve 150 g of reagent grade KCl in 500 mL deionized water and dilute to a 1000 mL.
3. Standard calibration solutions of NH_4-N. Prepare six calibration standards ranging from 0.1 to 20.0 mg L^{-1} concentration, diluted in 2.0 N KCl extraction solution prepared from 1000 mg L^{-1} NO_3-N standard solution.

Procedure

1. Weigh 20.0 ± 0.05 g of air-dried soil pulverized to pass 10 mesh sieve (< 2.0 mm) into 125 mL extraction vessel. Add 25.0 mL of deionized water using repipette dispenser, stir well with a glass rod and add a 2^{nd} aliquot of 25.0 mL of deionized water (See Comment #1 and #2).
2. Cover mouth of extraction vessel with parafilm and then plastic and tightly secure with lid.
3. Place extraction vessel(s) in incubator at 40.0 °C for 7 days (168 hours).
4 remove from incubator and add 50.0 mL of 2.0 N KCl using repipette dispenser.
5. Place extraction vessel(s) on reciprocating mechanical shaker for sixty (60) minutes
6. Filter extract (See Comment #3), refilter if filtrate is cloudy (See Comment #2).
7. Repeat using Method S-3.50 for extractable NH_4-N utilizing the same soil(s), reference soil.
8. Ammonium-N content of the extract is determined using a spectrophotometer, diffusion-conductivity instruments or distillation techniques using standard calibration solutions (See Comment #4 and #5). The ammonium nitrogen content of the digest solution can be determined with a rapid flow analyzer (Technicon Method No. 334-74A/A) or an flow injection analyzer (FIA). This determination can also be made using the Kjeldahl distillation method. Adjust and operate instruments in accordance with manufacturer's instructions. Determine ammonium concentration of a method blank and unknown samples.

Calculation

Mineralizable NH_4-N mg kg^{-1} in soil = (NH_4-N mg L^{-1} incubated - reference extract) × 5

Report mineralizable soil nitrogen concentration to the nearest 0.1 mg kg^{-1} (See Comment #6)

Comments

1. It is recommended that samples be rapidly air dried at ambient temperature immediately after sampling to minimize mineralization to nitrate.

2. Check repipette dispensing volume calibration using an analytical balance.

3. Check filter paper supply for possible contamination of and NH_4-N. If contamination is greater than 0.2 mg L^{-1} on a solution basis, rinse filter paper with 2.0 N KCl.

4. Samples having ammonium concentrations exceeding the highest standard will require dilution and reanalysis.

5. It is recommended that soils extracted for ammonium be analyzed with in two (2) hours after extraction

6. Mineralizable N (NH_4-N) results can be expressed on a volume basis. Assuming the sample represents a 0-6 inch (0-15 cm) depth of the soil, then: NH_4-N mg kg^{-1} × 2.0 $\cong$ NH_4-N lbs ac^{-1}

Literature

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Keeney, D.R. and D.W. Nelson. 1982. Nitrogen-inorganic forms. *In* A.L. Page (eds.) Methods of soil analysis, part 2. Agron. Monogr. 9, 2nd ed. ASA and SSSA, Madison, WI. p. 643-698.

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